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MOUNT  
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ABSTRACT:

PURPOSE: To provide a printed wiring board for BGA package which prevents short-circuit between electrode pads due to superfluous bonding agent and imperfect bonding due to insufficient bonding agent, and surely enables visual inspection of defect, and improve packaging density by effectively arranging electrode pads and through hole lands.

CONSTITUTION: In a printed wiring board 1 for BGA package, through hole lands 3L are arranged. The through hole land is formed in the vicinity of

periphery of an electrode pad 2 connected with a spherical outer electrode of a BGA package, and constituted as a unified body with the electrode pad 2. The electrode pad 2 and the through hole land 3L are formed in a plane where the width is gradually decreased. The fluidity of superfluous bonding agent is accelerated, and made to flow smoothly into through holes positioned in the central parts of the through hole lands 3L. The through hole lands 3L are arranged in the oblique direction, while the electrode pads 2 are set as the centers.

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## 【特許請求の範囲】

【請求項1】 BGAパッケージが搭載される印刷配線基板において、

前記BGAパッケージの球状外部端子に電氣的かつ機械的に接続され、前記球状外部端子の配列位置及び配列個数に応じて実装面上に配置される電極パッドと、

前記電極パッドの周囲の近接した位置において前記実装面上に配置され、前記電極パッドと同一層及び同一材料で一体に形成され、基板内部に配設された内層配線に電氣的に接続されたスルーホールランドと、

を備えたことを特徴とするBGAパッケージ搭載用印刷配線基板。

【請求項2】 前記請求項1に記載される印刷配線基板において、

前記一体に形成された電極パッド及びスルーホールランドは、電極パッド側から前記スルーホールランド側に向かって幅が漸減される平面形状で形成されることを特徴とするBGAパッケージ搭載用印刷配線基板。

【請求項3】 前記請求項1又は請求項2に記載される印刷配線基板において、

前記電極パッドは行方向、列方向のいずれにも複数配列され、

前記スルーホールランドはこのスルーホールランドに一体に形成された電極パッドを中心に電極パッドが配列される行方向、列方向のいずれに対しても傾斜角度を有する斜め方向に配置されることを特徴とするBGAパッケージ搭載用印刷配線基板。

【請求項4】 前記請求項3に記載される印刷配線基板において、

前記電極パッドとこの電極パッドに接続されるスルーホールランドとの間の距離は前記スルーホールランドとこのスルーホールランドが配置される斜め方向に隣接する他の電極パッドとの間の距離に比べて小さく設定されることを特徴とするBGAパッケージ搭載用印刷配線基板。

【請求項5】 前記請求項1又は請求項2に記載される印刷配線基板において、

前記電極パッド及びこの電極パッドに接続されたスルーホールランドは電極パッドが配列される行方向上又は列方向上に配置されることを特徴とするBGAパッケージ搭載用印刷配線基板。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明はBGA（ボールグリッドアレイ）パッケージが搭載される印刷配線基板に関する。特に本発明は、BGAパッケージの球状外部電極が接続される電極パッドを有する印刷配線基板に関する。本発明においては、BGAパッケージの球状外部電極と印刷配線基板の電極パッドとの間の電氣的かつ機械的な接合（例えば、半田接合）が良好に行える印刷配線基板

に関する。

## 【0002】

【従来の技術】BGAパッケージにおいては、パッケージ下面に球状外部端子が配列され、パッケージの外側面の周囲に接続用外部端子が突出しないので、印刷配線基板の実装面上に高密度実装ができる。さらに、BGAパッケージは表面実装部品であり、印刷配線基板の表面及び裏面の両面の実装面上に各々BGAパッケージが実装できるので、印刷配線基板の実装面上に高密度実装ができる。

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【0003】図4は従来技術に係るBGAパッケージ搭載用印刷配線基板の平面図であり、図5はBGAパッケージが実装された状態において前記図4に示す切断線F5-F5で切った印刷配線基板の縦断面図である。図5に示すように、印刷配線基板1の実装面上にはBGAパッケージ6が実装される。図4及び図5に示すように、印刷配線基板1の実装面上には、BGAパッケージのパッケージ下面に配列された球状外部電極8の配列位置及び配列個数に対応し、実装面において行方向、列方向のいずれにも規則的に配列された複数の電極パッド2が設けられる。BGAパッケージ6の球状外部電極8と印刷配線基板1の電極パッド2との間の接続は接合剤7で行われ、接合剤7には半田が使用される。複数の電極パッド2には各々スルーホールランド3Lが電氣的に接続され、電極パッド2とスルーホールランド3Lとの間の接続は接続用配線23で行われる。スルーホールランド3Lは印刷配線基板1に形成されたスルーホールに埋め込まれたスルーホール配線3Tに電氣的に接続され、このスルーホール配線3Tには印刷配線基板1の内部に配設された内層配線（図示しない）に電氣的に接続される。

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【0004】前記印刷配線基板1の実装面上にBGAパッケージ6及び他の実装部品を実装する実装方法は以下の手順で行われる。

【0005】まず、印刷配線基板製造時にBGAパッケージ6の電極パッド2（他の実装部品が接続される電極パッドを含む）及びスルーホールランド3Lを除き、印刷配線基板1の実装面上にソルダレジストが塗布される。実装第1工程においては、BGAパッケージ6の電極パッド2上にクリーム半田が塗布される。クリーム半田は接合剤7として使用され、このクリーム半田は例えば印刷技術で塗布される。第2工程においては、印刷配線基板1の実装面上にBGAパッケージ6が搭載され、印刷配線基板1の電極パッド2上にクリーム半田を介してBGAパッケージ6の球状外部電極8が当接される。BGAパッケージ6は装着装置等で搭載される。第3工程においては、前記印刷配線基板1がリフロー炉に搬送され、リフロー炉においてクリーム半田が加熱溶融され、半田リフローが行われる。この半田リフローにより、電極パッド2と球状外部電極8との間が接合剤7で接合され、印刷配線基板1の実装面上にBGAパッケージ

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ジ6が実装される。

【0006】しかしながら、前記印刷配線基板1の実装面上にBGAパッケージ6が実装されてしまうと電極パッド2と球状外部電極8との間の接合部分が隠れてしまい、接合部分の（接合剤7の状態を検査する）外観不良検査が事実上行えない。従って、この種のBGAパッケージ6を実装する印刷配線基板1においては如何に接合部分の信頼性を確保するかが重要な課題として存在する。

【0007】さらに、半田リフローにおいては印刷配線基板1に熱が加えられ、印刷配線基板1に反り、歪み等の変形が発生しやすい。印刷配線基板1に変形が発生した場合には電極パッド2と球状外部電極8との間に隙間が生じ、接合剤7の不足に起因する接合不良が発生する。また、接合剤7の不足を予測し予め接合剤7（クリーム半田）を多めに塗布しておく、逆に電極パッド2と球状外部電極8との間に隙間が生じない箇所においては接合剤7が過剰に存在する。このため、図5に示すように隣接する電極パッド2間（球状外部電極8間）において余剰の接合剤7が互いに連結する短絡部7Sが生成され、電極パッド2間に短絡が発生する。

【0008】特開平1-258454号公報には前述の外観不良検査が困難な点を改善できる技術が開示されている。この公報に開示された技術においてはパッケージ下面の電極部にパッケージ上面まで達するスルーホールが形成される。パッケージを半田付けで実装基板に実装する際に前記スルーホール内を這い上がる半田の存在が確認され、この半田の這上がりがあるか否かで外観不良検査において良否が判定される。

【0009】さらに、実開平4-87682号公報には前述の余剰の接合剤7に起因する電極パッド2間の短絡が防止できる技術が開示されている。この公報に開示された技術においては半田パッド（前述の電極パッド2に相当する）の中央部にスルーホールが形成される。このスルーホールには余剰な半田が流し込まれるので、余剰な半田に起因する半田パッド間の短絡が防止できる。

【0010】

【発明が解決しようとする課題】しかしながら、従来技術においては以下の点の配慮がなされていない。

（1）前述の図4及び図5に示す印刷配線基板1においては、電極パッド2から接続用配線23及びスルーホールランド3Lを通してスルーホールに繋がる余剰な接合剤7Lを逃がす経路が形成される。ところが、接続用配線23は電極パッド2、スルーホールランド3Lの各々の外形寸法に比べて小さい幅寸法でしかも均一な幅寸法で形成される。さらに、接続用配線23は電極パッド2、スルーホールランド3Lの各々と別の層でかつ別の材料で形成される。このため、余剰な接合剤7Lを逃がす経路においては、電極パッド2から接続用配線23に至る部分で急激に経路幅が減少され、余剰な接合剤7L

は逃げにくく、実際には余剰な接合剤7Lを逃がす経路としては機能しない。従って、前述のように余剰の接合剤7Lに起因する電極パッド2間の短絡が発生する。

【0011】（2）前述の図4及び図5に示す印刷配線基板1においては、隣接する4つの電極パッド2で周囲が囲まれた領域の中央にスルーホールランド3Lが配置される。このため、電極パッド2とスルーホールランド3Lとの間には、図4中、上下方向、左右方向に延在する外層配線が実質的に通せないもので、外層配線は電極パッド2の配列領域及びスルーホールランド3Lの配列領域を迂回し引き回される。従って、印刷配線基板1の実装面上には引き回し配線の余分な配置領域が必要になるので、印刷配線基板1において実装効率が減少する。

【0012】（3）前述の特開平1-258454号公報に開示された技術においては、確かに目視による外観不良検査が行えるが、パッケージ側にスルーホールが形成されるので、パッケージ内の素子及び配線を避けてスルーホールが形成される。この結果、スルーホールが形成される分、パッケージの寸法が大きくなるので、実装基板の実装面上において実装効率が低くなる。

【0013】（4）前述の実開平4-87682号公報に開示された技術においては、半田リフローで印刷配線基板1に変形が発生し、半田パッド上に隙間が生じる箇所においても半田がスルーホール内に流れ込んでしまう。このため、隙間が生じる箇所においては半田の不足による接合不良が発生する。

【0014】本発明は前述の課題を解決するためになされたものであり、本発明の目的は下記の通りである。

【0015】（1）本発明は、余剰な接合剤に起因する電極パッド間の短絡を防止し、接合剤の不足に起因する接合不良を防止するとともに、外観不良検査が確実に行える、BGAパッケージが搭載される印刷配線基板の提供を目的とする。

【0016】（2）本発明は、電極パッド及びスルーホールランドを効率良く配列し、実装密度が向上できる、BGAパッケージが搭載される印刷配線基板の提供を目的とする。

【0017】

【課題を解決するための手段及び作用】上記課題を解決するため、請求項1に係る発明は、BGAパッケージが搭載される印刷配線基板において、前記BGAパッケージの球状外部電極に電氣的かつ機械的に接続され、前記球状外部電極の配列位置及び配列個数に応じて実装面上に配置される電極パッドと、前記電極パッドの周囲の近接した位置において前記実装面上に配置され、前記電極パッドと同一層及び同一材料で一体に形成され、基板内部に配設された内層配線に電氣的に接続されたスルーホールランドと、を備えたことを特徴とする。

【0018】請求項1に係る発明においては、熱処理（例えば、半田リフロー）に起因し発生する印刷配線基

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板とBGAパッケージとの間の隙間を吸収するためにBGAパッケージの球状外部電極と印刷配線基板の電極パッドとの間に過剰の接合剤(例えば、半田)が使用される場合に、余剰の接合剤がスルーホールランド内(スルーホール内)に流し込める。前記電極パッドとスルーホールランドとは一体に形成され、余剰の接合剤が流動する経路である電極パッドの表面及びスルーホールランドの表面が段差を減少した滑らかな表面で形成されるので、余剰の接合剤においては流動性が促進される。従って、隣接する電極パッド間が余剰の接合剤で繋がる短絡の発生が減少できる。さらに、余剰の接合剤はスルーホール内に流しこまれるので、この余剰の接合剤に基づき外観不良検査が行える。

【0019】請求項2に係る発明は、前記請求項1に記載される印刷配線基板において、前記一体に形成された電極パッド及びスルーホールランドが電極パッド側から前記スルーホールランド側に向かって幅が漸減される平面形状で形成されることを特徴とする。

【0020】請求項2に係る発明においては、電極パッド上に形成された接合剤のうち余剰の接合剤が電極パッドからスルーホールランドに徐々にしかもスムーズに流し込める。

【0021】請求項3に係る発明は、前記請求項1又は請求項2に記載される印刷配線基板において、前記電極パッドは行方向、列方向のいずれにも複数配列され、前記スルーホールランドはこのスルーホールランドに一体に形成された電極パッドを中心に電極パッドが配列される行方向、列方向のいずれに対しても傾斜角度を有する斜め方向に配置されることを特徴とする。

【0022】請求項3に係る発明においては、前記スルーホールランドが配置された位置を前記電極パッドが配列される行方向上、列方向上に各々投影すると、電極パッドとこの電極パッドに一体に形成されたスルーホールランドとの間の距離が見掛け短縮できる。つまり、電極パッドが配列される行方向、列方向において、電極パッドに接続されたスルーホールランドと隣接する他の電極パッドとの間のスペースが確保できるので、電極パッドの配列間隔が縮小でき、実装面上に電極パッドが高密度で配列できる。さらに、前記電極パッドに接続されたスルーホールランドと隣接する他の電極パッドとの間のスペースが確保できるので、このスペースに配線が配置できる。電極パッド間に配線が配置できると電極パッドを迂回する引回し配線が減少できるので、実装面上に配線が高密度で配置できる。

【0023】請求項4に係る発明は、前記請求項3に記載される印刷配線基板において、前記電極パッドとこの電極パッドに接続されるスルーホールランドとの間の距離が前記スルーホールランドとこのスルーホールランドが配置される斜め方向に隣接する他の電極パッドとの間の距離に比べて小さく設定されることを特徴とする。

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【0024】請求項4に係る発明においては、スルーホールランドと隣接する他の電極パッドとの間にスペースが確保できるので、このスペースに配線が配置できる。従って、引回し配線が減少でき、実装面上に配線が高密度で配置できる。

【0025】請求項5に係る発明は、前記請求項1又は請求項2に記載される印刷配線基板において、前記電極パッド及びこの電極パッドに接続されたスルーホールランドが電極パッドを配列する行方向上又は列方向上に配置されることを特徴とする。

【0026】請求項5に係る発明においては、電極パッドが配列される列方向又は行方向にはスルーホールランドが配置されないで、この方向において電極パッド間にスペースが確保でき、このスペースに配線が配置できる。従って、引回し配線が減少でき、実装面上に配線が高密度で配置できる。

【0027】

【実施例】

実施例1

図1は本発明の実施例1に係るBGAパッケージ用印刷配線基板の一部を示す平面図、図2はBGAパッケージを実装した状態において前記図1に示す切断線F2-F2で切った縦断面図である。

【0028】図2に示すように、印刷配線基板1の実装面上にはBGAパッケージ6が実装される。図1及び図2に示すように、印刷配線基板1の実装面上には、BGAパッケージのパッケージ下面に配列された球状外部電極8の配列位置及び配列個数に対応し、実装面において行方向、列方向のいずれにも規則的に配列された複数の電極パッド2が設けられる。実装面上において電極パッド2の周囲の近接した位置にはスルーホールランド3Lが配置される。

【0029】前記電極パッド2は球状外部電極8に接続するのに必要な寸法及び形状で形成され、電極パッド2は少なくとも球状外部電極8を実装面上に投影した円形と同一又は類似した形状で形成される。スルーホールランド3Lは前記電極パッド2と同一層及び同一材料で一体に形成され、スルーホールランド3Lと前記電極パッド2とは電氣的に接続される。前記電極パッド2とスルーホールランド3Lとが一体に形成されると、電極パッド2の表面及びスルーホールランド3Lの表面の段差が減少され滑らかな表面が形成される。電極パッド2からスルーホールランド3Lまでは余剰の接合剤7Lが流動する経路に相当し、余剰の接合剤7Lの流動性が促進される。

【0030】本実施例においては1つの電極パッド2に1つのスルーホールランド3Lが接続されるが、本発明においては1つの電極パッド2に複数のスルーホールランド3Lを又は複数の電極パッド2に1つのスルーホールランド3Lを接続する場合が含まれる。

【0031】前記電極パッド2の外形サイズに比べてスルーホールランド3Lの外形サイズは小さく設定され、一体に形成された電極パッド2及びスルーホールランド3Lは電極パッド2側から前記スルーホールランド3L側に向かって幅が漸減される平面形状で形成される。電極パッド2上に接合剤7が塗布されるとこの塗布された接合剤7のうち余剰の接合剤7Lは電極パッド2からスルーホールランド3Lの中央部に位置するスルーホール内に徐々にしかもスムーズに流し込める。電極パッド2と球状外部電極8との間の接合に必要な最小限の接合剤7は電極パッド2の表面上に濡れ性により確保される。

【0032】スルーホールランド3Lは印刷配線基板1に形成されたスルーホールに埋め込まれたスルーホール配線3Tに電気的に接続される。スルーホール配線3Tには印刷配線基板1の内部に配設された内層配線5が電気的に接続される。スルーホール内に流し込まれる余剰の接合剤7Lは印刷配線基板1の裏面から観測でき、この余剰の接合剤7Lに基づき外観不良検査が行える。

【0033】前記電極パッド2の行方向及び列方向の配列に対して、スルーホールランド3Lはこのスルーホールランド3Lに一体に形成された電極パッド2を中心に電極パッド2が配列される行方向、列方向のいずれに対しても傾斜角度を有する斜め方向に配置される。すなわち、図1に示すように、行方向に隣接する2つの電極パッド2及び列方向に隣接する2つの電極パッド2の合計4つの電極パッド2の各中心点を結んで便宜的に破線で図示した四角形の対角線上に沿ってスルーホールランド3Lが形成される。スルーホールランド3Lが配置された位置を前記電極パッド2が配列される行方向上、列方向上に各々投影すると、電極パッド2とこの電極パッド2に一体に形成されたスルーホールランド3Lとの間の距離La、Lbが各々見掛上短縮できる。つまり、電極パッド2が配列される行方向、列方向において、電極パッド2に接続されたスルーホールランド3Lと隣接する他の電極パッド2との間のスペースが確保できるので、電極パッド2の配列間隔LA、LBが各々縮小できる。表現を代えれば、電極パッド2に接続されたスルーホールランド3Lと隣接する他の電極パッド2との間のスペースが確保できるので、このスペースに同図1に示すように外層配線4が配置できる。

【0034】さらに、前記電極パッド2とこの電極パッド2に接続されるスルーホールランド3Lとの間の距離Lcが前記スルーホールランド3Lとこのスルーホールランド3Lが配置される斜め方向に隣接する他の電極パッド2との間の距離LCに比べて小さく設定される。すなわち、前述の便宜的に図示した四角形の中心点Pに達しない寸法において前記電極パッド2とスルーホールランド3Lとが一体に形成される。従って、スルーホールランド3Lと隣接する他の電極パッド2との間にはスペースが確保できる。確保されたスペースには外層配線4

が配置できる。

【0035】前記BGAパッケージ6の球状外部電極8と印刷配線基板1の電極パッド2との間の接続は接合剤7で行われ、接合剤7には例えば半田が使用される。

【0036】次に、前述の印刷配線基板1の実装面上にBGAパッケージ6（及び他の実装部品）を実装する実装方法について説明する。

【0037】まず、印刷配線基板製造時にBGAパッケージ6の電極パッド2（他の実装部品が接続される電極パッドを含む）及びスルーホールランド3Lを除き、印刷配線基板1の実装面上にソルダレジストが塗布される。実装第1工程においては、BGAパッケージ6の電極パッド2上にクリーム半田が塗布される。クリーム半田は接合剤7として使用され、このクリーム半田は例えば印刷技術で塗布される。第2工程においては、印刷配線基板1の実装面上にBGAパッケージ6が搭載され、印刷配線基板1の電極パッド2上にクリーム半田を介してBGAパッケージ6の球状外部電極8が当接される。BGAパッケージ6は装着装置等で搭載される。第3工程においては、前記印刷配線基板1がリフロー炉に搬送され、リフロー炉においてクリーム半田が加熱溶融され、半田リフローが行われる。この半田リフローにより、電極パッド2と球状外部電極8との間が接合剤7で接合され、印刷配線基板1の実装面上にBGAパッケージ6が実装される。

【0038】このように構成される印刷配線基板1においては以下の効果が得られる。

【0039】（1）実装時（半田リフロー時）に余剰な接合剤7Lが電極パッド2からスルーホールランド3Lを通してスルーホール内に流れ込み、接合剤7の量が調整されるので、余剰な接合剤7Lに起因する電極パッド2間の短絡が防止できる。

【0040】（2）スルーホールに流れ込む接合剤7Lは余剰のものに限られ、接合に必要な最小限の接合剤7は電極パッド2の表面に濡れ性により確保できるので、接合剤7の不足に起因する接合不良が防止できる。

【0041】（3）スルーホールに流れ込む接合剤7Lにより外観不良検査が確実にできる。

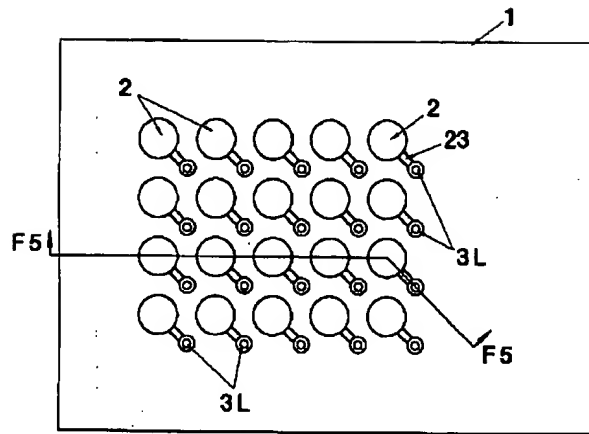
（4）電極パッド2及びスルーホールランド3Lが効率良く配列され、実装密度が向上できる。

【0042】実施例2. 図3は本発明の実施例2に係るBGAパッケージ用印刷配線基板の一部を示す平面図である。

【0043】図3に示すように、本実施例に係る印刷配線基板1においては電極パッド2及びこの電極パッド2に接続されたスルーホールランド3Lが電極パッド2を配列する行方向上（又は列方向上）に配置される。電極パッド2が配列される列方向にはスルーホールランド3Lが配置されないで、この方向において電極パッド2間にスペースが確保できる。このスペースには外層配線



【図4】



フロントページの続き

(51)Int.Cl.<sup>6</sup>  
H05K 3/34

識別記号  
501

庁内整理番号

FI  
H01L 23/12

技術表示箇所  
L

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the printed wiring substrate in which a BGA (ball grid array) package is carried. Especially this invention relates to the printed wiring substrate which has the electrode pad to which the spherical external electrode of a BGA package is connected. In this invention, it is related with the printed wiring substrate which can perform electric and mechanical junction between the spherical external electrode of a BGA package, and the electrode pad of a printed wiring substrate (for example, soldered joint) good.

[0002]

[Description of the Prior Art] in a BGA package, a spherical external terminal is arranged on the package inferior surface of tongue -- having -- the perimeter of the lateral surface of a package -- connection -- business -- since an external terminal does not project, high density assembly is made on the component side of a printed wiring substrate. Furthermore, a BGA package is a surface mounted device, and since a BGA package can be respectively mounted on the front face of a printed wiring substrate, and the component side of both sides on the back, high density assembly is made on the component side of a printed wiring substrate.

[0003] Drawing 4 is the top view of the printed wiring substrate for BGA package loading concerning the conventional technique, and drawing 5 is drawing of longitudinal section of the printed wiring substrate turned off by cutting-plane line F5-F5 shown in said drawing 4 in the condition that the BGA package was mounted. As shown in drawing 5, the BGA package 6 is mounted on the component side of the printed wiring substrate 1. As shown in drawing 4 and drawing 5, on the component side of the printed wiring substrate 1, it corresponds to the array location and the array number of the spherical external electrode 8 which were arranged on the package inferior surface of tongue of a BGA package, and two or more electrode pads 2 regularly arranged in the component side by both the line wiring direction and the direction of a train are formed. Connection between the spherical external electrode 8 of the BGA package 6 and the electrode pad 2 of the printed wiring substrate 1 is made with cement 7, and solder is used for cement 7. Through hole land 3L is respectively connected to two or more electrode pads 2 electrically, and connection between the electrode pad 2 and through hole land 3L is made with the wiring 23 for connection. It connects with through hole wiring 3T embedded in the through hole formed in the printed wiring substrate 1 electrically, and through hole land is electrically connected to inner layer wiring (not shown) arranged in the interior of the printed wiring substrate 1 through hole wiring 3T.

[0004] The mounting approach of mounting the BGA package 6 and other mounting components on the component side of said printed wiring substrate 1 is performed by the following procedures.

[0005] First, except for the electrode pad 2 (the electrode pad to which other mounting components are connected is included) of the BGA package 6, and through hole land 3L, solder resist is applied on the component side of the printed wiring substrate 1 at the time of printed wiring substrate manufacture. In the 1st process of mounting, cream solder is applied on the electrode pad 2 of the BGA package 6. Cream solder is used as cement 7 and this cream solder is applied for example, with a printing technique. In the 2nd process, the BGA package 6 is carried on the component side of the printed wiring substrate 1, and the spherical external electrode 8 of the BGA package 6 is contacted through cream solder on the electrode pad 2 of the printed wiring substrate 1. The BGA package 6 is carried with wearing equipment etc. In the 3rd process, said printed wiring substrate 1 is conveyed at a reflow furnace, heating melting of the cream solder is carried out in a reflow furnace, and a solder reflow is performed. Between the electrode pad 2 and the spherical external electrodes 8 is joined with cement 7 by this solder reflow, and the BGA package 6 is mounted on the component side of the printed wiring substrate 1.

[0006] However, if the BGA package 6 is mounted on the component side of said printed wiring substrate 1, the

amount of [ between the electrode pad 2 and the spherical external electrode 8 ] joint hides, and poor appearance (condition of cement 7 is inspected) inspection for a joint cannot be conducted as a matter of fact. Therefore, how the dependability for a joint is secured in the printed wiring substrate 1 which mounts this kind of BGA package 6 exists an important technical problem.

[0007] Furthermore, in a solder reflow, heat is applied to the printed wiring substrate 1, and it is easy to generate deformation of curvature, distortion, etc. in the printed wiring substrate 1. When deformation occurs in the printed wiring substrate 1, a clearance is generated between the electrode pad 2 and the spherical external electrode 8, and the poor junction resulting from lack of cement 7 occurs. Moreover, if lack of cement 7 is predicted and more cement 7 (cream solder) is applied beforehand, in the part which a clearance does not produce, cement 7 exists superfluously between the electrode pad 2 and the spherical external electrode 8 conversely. For this reason, short circuit section 7S which excessive cement 7 connects mutually between the electrode pads 2 which adjoin as shown in drawing 5 (between the spherical external electrodes 8) are generated, and a short circuit occurs between the electrode pads 2.

[0008] The technique in which a point with the above-mentioned appearance poor inspection difficult for a publication number I-No. 258454 official report is improvable is indicated. The through hole which reaches the polar zone under package to a package top face in the technique indicated by this official report is formed. In case a package is mounted in a mounting substrate with soldering, existence of the solder which creeps up the inside of said through hole is checked, this solder creeps up and a quality is judged [ in / by whether it is \*\*\*\*\* / a poor appearance inspection ].

[0009] Furthermore, the technique in which the short circuit between the electrode pads 2 resulting from the cement of the above-mentioned surplus can be prevented is indicated by JP,4-87682,U. A through hole is formed in the center section of the solder pad (it is equivalent to the above-mentioned electrode pad 2) in the technique indicated by this official report. Since surplus solder is slushed into this through hole, the short circuit between the solder pads resulting from surplus solder can be prevented.

[0010]

[Problem(s) to be Solved by the Invention] However, consideration of the following points is not made in the conventional technique.

(1) In the printed wiring substrate 1 shown in above-mentioned drawing 4 and above-mentioned drawing 5, the path which misses surplus cement 7L connected with a through hole through the wiring 23 for connection and through hole land 3L from the electrode pad 2 is formed. However, moreover, the wiring 23 for connection is formed with a uniform width-of-face dimension with a small width-of-face dimension compared with each dimension of the electrode pad 2 and through hole land 3L. Furthermore, the wiring 23 for connection is formed with the electrode pad 2 and another ingredient which is a layer different from each of through hole land 3L. For this reason, in the path which misses surplus cement 7L, path width of face decreases rapidly in the part from the electrode pad 2 to the wiring 23 for connection, and surplus cement 7L cannot escape easily and does not function as a path which misses surplus cement 7L in fact. Therefore, the short circuit between the electrode pads 2 which originate in excessive cement 7L as mentioned above occurs.

[0011] (2) In the printed wiring substrate 1 shown in above-mentioned drawing 4 and above-mentioned drawing 5, through hole land 3L is arranged in the center of the field where the perimeter was surrounded with four adjoining electrode pads 2. For this reason, between the electrode pad 2 and through hole land 3L, among drawing 4, since it cannot let substantially outer layer wiring which extends in the vertical direction and a longitudinal direction pass, outer layer wiring bypasses the array area of the electrode pad 2, and the array area of through hole land 3L, and is taken about. Therefore, since it takes about on the component side of the printed wiring substrate 1 and the excessive arrangement field of wiring is needed, mounting effectiveness decreases in the printed wiring substrate 1.

[0012] (3) In the technique indicated by the above-mentioned publication-number I-No. 258454 official report, although poor appearance inspection by viewing can be conducted to be sure, since a through hole is formed in a package side, the component in a package and wiring are avoided and a through hole is formed. Consequently, since the part in which a through hole is formed, and the dimension of a package become large, mounting effectiveness becomes low on the component side of a mounting substrate.

[0013] (4) In the technique indicated by above-mentioned JP,4-87682,U, deformation will occur in the printed wiring substrate 1 in a solder reflow, and solder will flow in a through hole also in the part which a clearance produces on solder pad. For this reason, the poor junction by lack of solder occurs in the part which a clearance produces.

[0014] Made in order that this invention may solve the above-mentioned technical problem, the purpose of this invention is as follows.

[0015] (1) This invention aims a poor appearance inspection at offer of the printed wiring substrate in which a BGA package is carried which can be ensured while it prevents the short circuit between the electrode pads resulting from

surplus cement and prevents the poor junction resulting from lack of cement.

[0016] (2) This invention arranges an electrode pad and a through hole land efficiently, and aims at offer of the print wiring substrate in which a BGA package is carried whose packaging density can improve.

[0017]

[Means for Solving the Problem and its Function] In order to solve the above-mentioned technical problem, invention concerning claim 1 The electrode pad which is connected to the spherical external electrode of said BGA package electrically and mechanically, and is arranged on a component side in the printed wiring substrate in which a BGA package is carried according to the array location and the array number of said spherical external electrode, In the location where the perimeter of said electrode pad approached, it is arranged on said component side, is formed in on with the same layer as said electrode pad, and the same ingredient, and is characterized by having the through hole la electrically connected to inner layer wiring arranged in the interior of a substrate.

[0018] In invention concerning claim 1, in order to absorb the clearance between the printed wiring substrates and BGA packages which originate in heat treatment (for example, solder reflow), and are generated, when superfluous cement (for example, solder) is used between the spherical external electrode of a BGA package, and the electrode p of a printed wiring substrate, excessive cement can slush in a through hole land (inside of a through hole). Since said electrode pad and through hole land are formed in one and the front face of the electrode pad which is the path for which excessive cement flows, and the front face of a through hole land are formed on the smooth front face which decreased in number the level difference, a fluidity is promoted in excessive cement. Therefore, generating of the sho circuit with which between adjoining electrode pads is connected with excessive cement can be decreased.

Furthermore, since excessive cement is poured in in a through hole, poor appearance inspection can be conducted ba on the cement of this surplus.

[0019] Invention concerning claim 2 is characterized by forming the electrode pad and through hole land which were formed in said one in the flat-surface configuration by which width of face is \*\*\*\*(ed) toward said through hole land side from an electrode pad side in the printed wiring substrate indicated by said claim 1.

[0020] Gradually moreover in invention concerning claim 2, excessive cement can slush into a through hole land smoothly from an electrode pad among the cement formed on the electrode pad.

[0021] In the printed-wiring substrate with which invention concerning claim 3 is indicated by said claim 1 or claim two or more arrays of said electrode pad are carried out at both a line writing direction and the direction of a train, an it is characterized by to arrange said through hole land in the line writing direction by which an electrode pad is arranged centering on the electrode pad formed in this through hole land at one, and the direction of slant which has whenever [ tilt-angle ] also to any of the direction of a train.

[0022] In invention concerning claim 3, if the location where said through hole land has been arranged is respectivel projected on the line writing direction by which said electrode pad is arranged, and the direction of a train, the distan between the through hole lands formed in an electrode pad and this electrode pad at one can be shortened seemingly. That is, in the line writing direction and the direction of a train in which an electrode pad is arranged, since the tooth space between other electrode pads which adjoin the through hole land connected to the electrode pad is securable, array spacing of an electrode pad can be reduced and an electrode pad can arrange by high density on a component side. Furthermore, since the tooth space between other electrode pads which adjoin the through hole land connected said electrode pad is securable, wiring can be arranged to this tooth space. Since leading-about wiring which bypasses an electrode pad can decrease in number if wiring can be arranged between electrode pads, wiring can arrange by high density on a component side.

[0023] Invention concerning claim 4 is characterized by setting up small the distance between the through hole lands connected to said electrode pad and this electrode pad compared with the distance between other electrode pads whic adjoin in the direction of slant in which said through hole land and this through hole land are arranged in the printed wiring substrate indicated by said claim 3.

[0024] In invention concerning claim 4, since a tooth space is securable among other electrode pads which adjoin a through hole land, wiring can be arranged to this tooth space. Therefore, it can decrease and wiring can arrange leading-about wiring by high density on a component side.

[0025] Invention concerning claim 5 is characterized by arranging the through hole land connected to said electrode pad and this electrode pad on the line writing direction which arranges an electrode pad, or the direction of a train in printed wiring substrate indicated by said claim 1 or claim 2.

[0026] In invention concerning claim 5, since a through hole land is not arranged at the direction of a train or line writing direction by which an electrode pad is arranged, in this direction, a tooth space can be secured between electrode pads, and wiring can be arranged to this tooth space. Therefore, it can decrease and wiring can arrange

leading-about wiring by high density on a component side.

[0027]

[Example]

The top view and drawing 2 which show some printed wiring substrates for a BGA package which example 1 drawin 1 requires for the example 1 of this invention are drawing of longitudinal section cut with cutting-plane-line F2-F2 shown in said drawing 1 in the condition of having mounted the BGA package.

[0028] As shown in drawing 2, the BGA package 6 is mounted on the component side of the printed wiring substrat 1. As shown in drawing 1 and drawing 2, on the component side of the printed wiring substrate 1, it corresponds to array location and the array number of the spherical external electrode 8 which were arranged on the package inferior surface of tongue of a BGA package, and two or more electrode pads 2 regularly arranged in the component side by both the line writing direction and the direction of a train are formed. Through hole land 3L is arranged in the locatio where the perimeter of the electrode pad 2 approached on the component side.

[0029] Said electrode pad 2 is formed in a dimension and a configuration required to connect with the spherical external electrode 8, and the electrode pad 2 projected the spherical external electrode 8 on the component side at lea and is formed in the same or a similar configuration with it being circular. Through hole land 3L is formed in one wi the same layer as said electrode pad 2, and the same ingredient, and through hole land 3L and said electrode pad 2 ar connected electrically. If said electrode pad 2 and through hole land 3L are formed in one, the level difference of the front face of the electrode pad 2 and the front face of through hole land 3L will decrease, and a smooth front face will be formed. The electrode pad 2 to through hole land 3L is equivalent to the path for which excessive cement 7L flow and the fluidity of excessive cement 7L is promoted.

[0030] although one through hole land 3L is connected to one electrode pad 2 in this example -- this invention -- sett -- through hole land 3L of plurality [ pad / 2 / one / electrode ] -- or the case where one through hole land 3L is connected to two or more electrode pads 2 is included.

[0031] Compared with the appearance size of said electrode pad 2, the appearance size of through hole land 3L is set small, and the electrode pad 2 and through hole land 3L which were formed in one are formed in the flat-surface configuration by which width of face is \*\*\*\*(ed) toward said through hole land 3L side from the electrode pad 2 sid If cement 7 is applied on the electrode pad 2, gradually moreover, excessive cement 7L can be smoothly slushed amo this applied cement 7 in the through hole located in the center section of through hole land 3L from the electrode pad The minimum cement 7 required for junction between the electrode pad 2 and the spherical external electrode 8 is secured by wettability on the front face of the electrode pad 2.

[0032] Through hole land 3L is electrically connected to through hole wiring 3T embedded in the through hole form in the printed wiring substrate 1. The inner layer wiring 5 arranged in the interior of the printed wiring substrate 1 is electrically connected to through hole wiring 3T. Cement 7L of the surplus slushed in a through hole can be observe from the rear face of the printed wiring substrate 1, and can conduct poor appearance inspection based on cement 7L this surplus.

[0033] Through hole land 3L is arranged to the array of the line writing direction of said electrode pad 2, and the direction of a train in the line writing direction by which the electrode pad 2 is arranged centering on the electrode pa 2 formed in this through hole land 3L at one, and the direction of slant which has whenever [ tilt-angle ] also to any o the direction of a train. That is, as shown in drawing 1, through hole land 3L is formed along the diagonal line top o the square which connected each central point of a total of four electrode pads 2 of two electrode pads 2 which adjoin in two electrode pads 2 and the direction of a train which adjoin a line writing direction, and was illustrated with the broken line for convenience. If the location where through hole land 3L has been arranged is respectively projected o the line writing direction by which said electrode pad 2 is arranged, and the direction of a train, the distance La and L between through hole land 3L formed in the electrode pad 2 and this electrode pad 2 at one can be shortened seeming respectively. That is, in the line writing direction and the direction of a train in which the electrode pad 2 is arranged since the tooth space between other electrode pads 2 which adjoin through hole land 3L connected to the electrode p 2 is securable, the array spacing LA and LB of the electrode pad 2 can contract respectively. If an expression is replaced with, since the tooth space between other electrode pads 2 which adjoin through hole land 3L connected to electrode pad 2 is securable, as shown in this drawing 1, the outer layer wiring 4 can be arranged to this tooth space.

[0034] Furthermore, the distance Lc between through hole land 3L connected to said electrode pad 2 and this electro pad 2 is small set up compared with the distance LC between other electrode pads 2 which adjoin in the direction of slant in which said through hole land 3L and this through hole land 3L are arranged. That is, in the dimension which does not arrive at the central point P of the above-mentioned square illustrated for convenience, said electrode pad 2 and through hole land 3L are formed in one. Therefore, among other electrode pads 2 which adjoin through hole land

3L, a tooth space is securable. The outer layer wiring 4 can be arranged in the secured tooth space.

[0035] Connection between the spherical external electrode 8 of said BGA package 6 and the electrode pad 2 of the printed wiring substrate 1 is made with cement 7, and solder is used for cement 7.

[0036] Next, the mounting approach of mounting the BGA package 6 (and other mounting components) on the component side of the above-mentioned printed wiring substrate 1 is explained.

[0037] First, except for the electrode pad 2 (the electrode pad to which other mounting components are connected is included) of the BGA package 6, and through hole land 3L, solder resist is applied on the component side of the printed wiring substrate 1 at the time of printed wiring substrate manufacture. In the 1st process of mounting, cream solder is applied on the electrode pad 2 of the BGA package 6. Cream solder is used as cement 7 and this cream solder is applied, for example, with a printing technique. In the 2nd process, the BGA package 6 is carried on the component side of the printed wiring substrate 1, and the spherical external electrode 8 of the BGA package 6 is contacted through cream solder on the electrode pad 2 of the printed wiring substrate 1. The BGA package 6 is carried with wearing equipment etc. In the 3rd process, said printed wiring substrate 1 is conveyed at a reflow furnace, heating melting of the cream solder is carried out in a reflow furnace, and a solder reflow is performed. Between the electrode pad 2 and the spherical external electrodes 8 is joined with cement 7 by this solder reflow, and the BGA package 6 is mounted on the component side of the printed wiring substrate 1.

[0038] Thus, the following effectiveness is acquired in the printed wiring substrate 1 constituted.

[0039] (1) Since surplus cement 7L flows in in a through hole through through hole land 3L from the electrode pad 2 and the amount of cement 7 is adjusted at the time of mounting (at the time of a solder reflow), the short circuit between the electrode pads 2 resulting from surplus cement 7L can be prevented.

[0040] (2) Since cement 7L which flows into a through hole is restricted to an excessive thing and the minimum cement 7 required for junction can be secured in the front face of the electrode pad 2 by wettability, the poor junction resulting from lack of cement 7 can be prevented.

[0041] (3) Cement 7L which flows into a through hole can perform poor appearance inspection.

(4) The electrode pad 2 and through hole land 3L are arranged efficiently, and packaging density can be improved.

[0042] Example 2. drawing 3 is the top view showing some printed wiring substrates for a BGA package concerning the example 2 of this invention.

[0043] As shown in drawing 3, through hole land 3L connected to the electrode pad 2 and this electrode pad 2 in the printed wiring substrate 1 concerning this example is arranged on the line writing direction which arranges the electrode pad 2 (or on the direction of a train). Since through hole land 3L is not arranged in the direction of a train in which the electrode pad 2 is arranged, in this direction, a tooth space is securable between the electrode pads 2. Since the outer layer wiring 4 can be arranged in this tooth space, leading-about wiring can be decreased.

[0044] Although the flat-surface configuration with which the electrode pad 2 and through hole land 3L were united formed in an ellipse configuration as this example is shown in this drawing 3, in this invention, said unified configuration may be a rectangle.

[0045] Thus, the effectiveness acquired with the printed wiring substrate 1 applied to the above-mentioned example in the printed wiring substrate 1 constituted and the same effectiveness are acquired.

[0046]

[Effect of the Invention] The following effectiveness is acquired in this invention.

(1) This invention can offer the printed wiring substrate which can ensure poor appearance inspection and in which a BGA package is carried while it can prevent the short circuit between the electrode pads resulting from surplus cement and can prevent the poor junction resulting from lack of cement.

[0047] (2) This invention can offer the printed wiring substrate with which an electrode pad and a through hole land can arrange efficiently, and packaging density's can improve and in which a BGA package is carried.

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[Translation done.]

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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 CLAIMS
 

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[Claim(s)]

[Claim 1] The electrode pad which is connected to the spherical external terminal of said BGA package electrically and mechanically, and is arranged on a component side in the printed wiring substrate in which a BGA package is carried according to the array location and the array number of said spherical external terminal, The through hole land electrically connected to inner layer wiring which has been arranged on said component side in the location where the perimeter of said electrode pad approached, was formed in one with the same layer as said electrode pad, and the same ingredient, and was arranged in the interior of a substrate, The printed wiring substrate for BGA package loading characterized by preparation \*\*\*\*\*.

[Claim 2] The electrode pad and through hole land which were formed in said one in the printed wiring substrate indicated by said claim 1 are a printed wiring substrate for BGA package loading characterized by being formed in the flat-surface configuration by which width of face is \*\*\*\*(ed) toward said through hole land side from an electrode pad side.

[Claim 3] It is the printed-wiring substrate for BGA package loading which two or more arrays of said electrode pad are carried out at both a line writing direction and the direction of a train, and is characterized by to arrange said through hole land in the line writing direction by which an electrode pad is arranged centering on the electrode pad formed in this through hole land at one, and the direction of slant which has whenever [ tilt-angle ] also to any of the direction of a train in the printed-wiring substrate indicated by said claim 1 or claim 2.

[Claim 4] The distance between the through hole lands connected to said electrode pad and this electrode pad in the printed wiring substrate indicated by said claim 3 is a printed wiring substrate for BGA package loading characterized by being small set up compared with the distance between other electrode pads which adjoin in the direction of slant which said through hole land and this through hole land are arranged.

[Claim 5] The through hole land connected to said electrode pad and this electrode pad in the printed wiring substrate indicated by said claim 1 or claim 2 is a printed wiring substrate for BGA package loading characterized by being arranged on the line writing direction by which an electrode pad is arranged, or the direction of a train.

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[Translation done.]

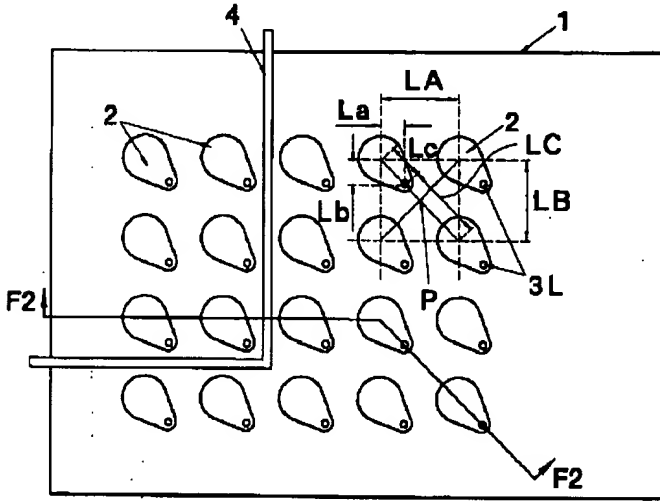
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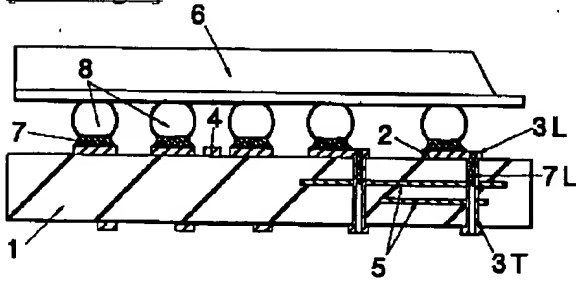
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## DRAWINGS

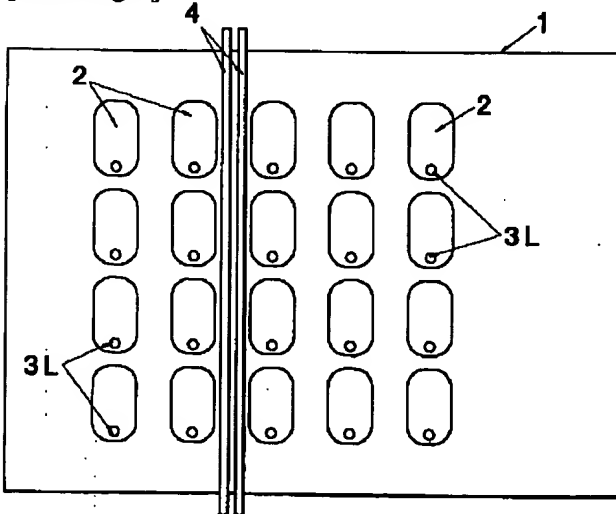
[Drawing 1]



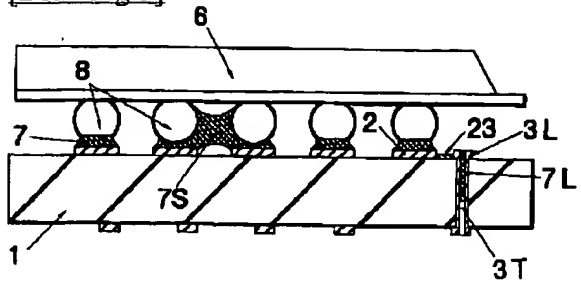
[Drawing 2]



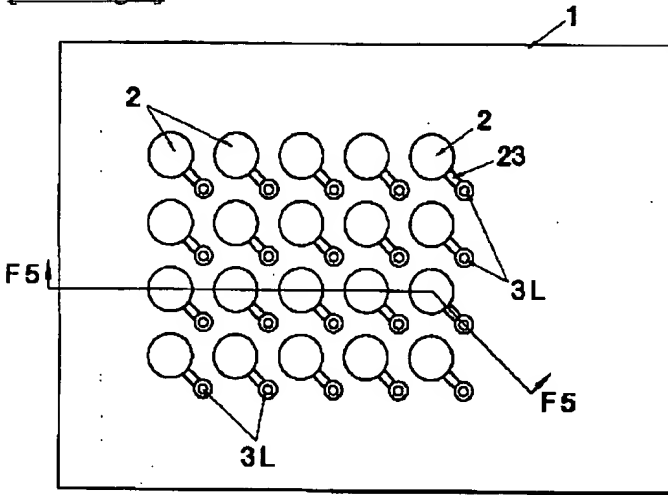
[Drawing 3]



[Drawing 5]



[Drawing 4]



[Translation done.]